SIRTF

Space Infrared Telescope Facility

to be presented at

COSPAR Symposium: "New Results in Infrared and Sub-Millimeter Astronomy", Warsaw, July 2000

International Astronomical Union Symposium: "The Extragalactic Infrared Background and its Cosmological Implications" Birmingham, August 2000

by

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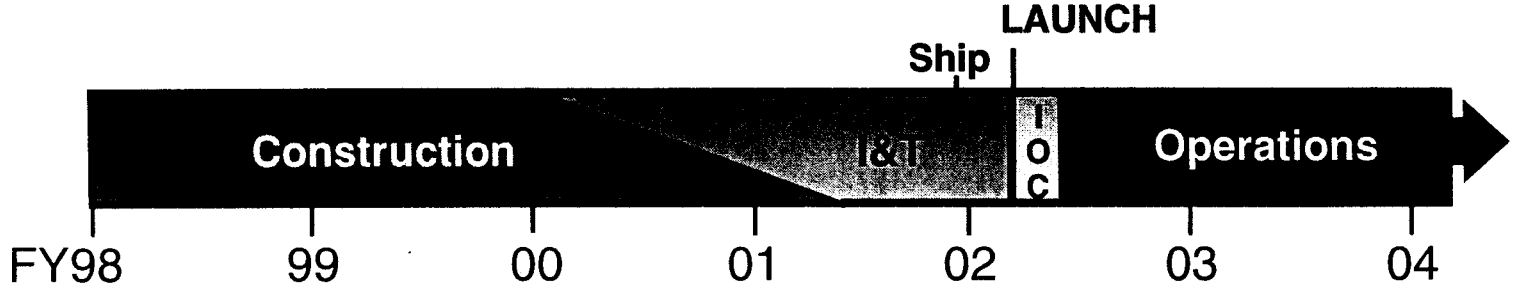
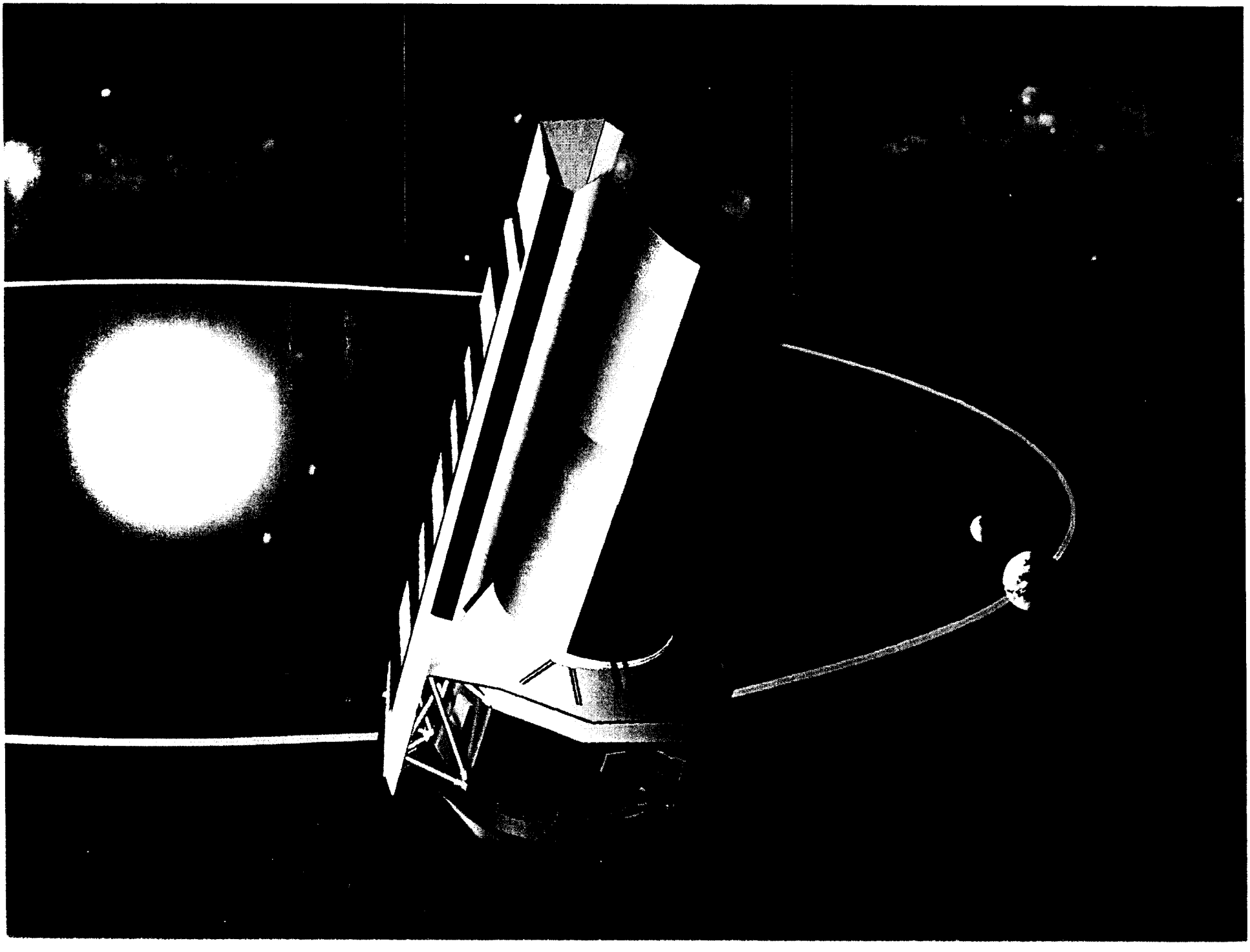
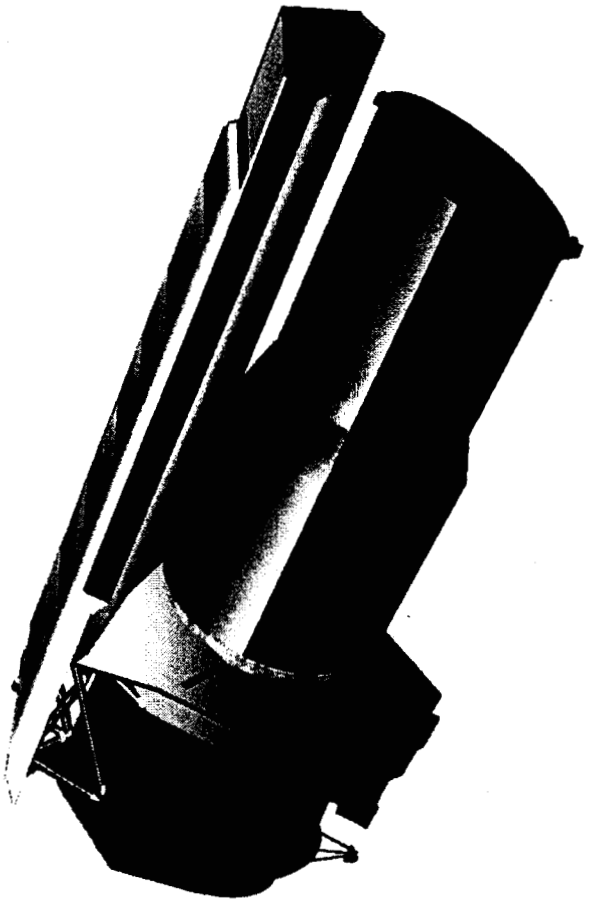
Jet Propulsion Laboratory, California Institute of Technology



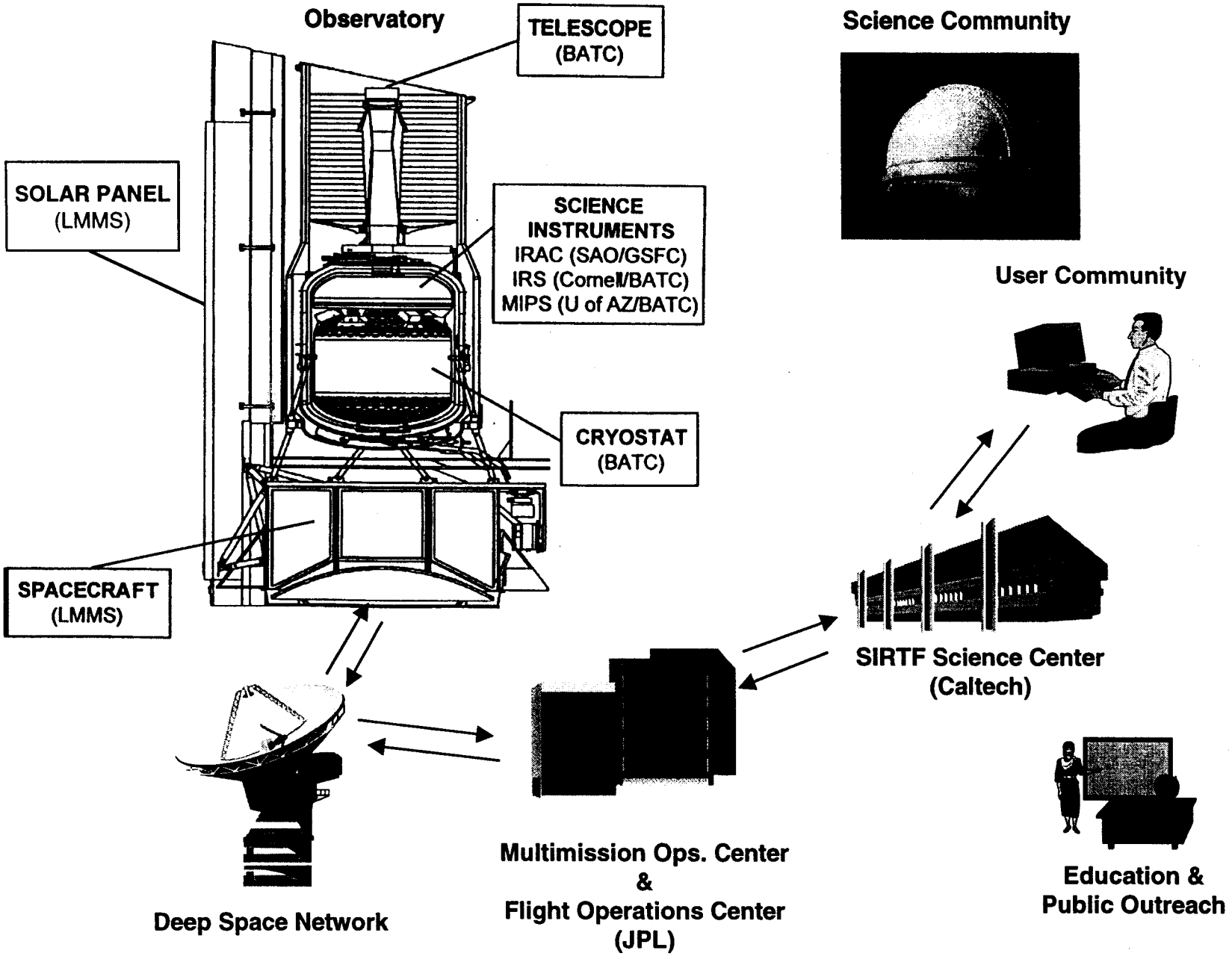


JPL Space Infrared Telescope Facility SIRTF

- **Infrared Great Observatory**
  - *Background Limited Performance 3 -- 180um*
  - *85 cm f/12 Beryllium Telescope, T < 5.5K*
  - *6.5um Diffraction Limit*
  - *New Generation Detector Arrays*
  - *Instrumental Capabilities*
    - Imaging/Photometry, 3-180um
    - Spectroscopy, 5-40um
    - Spectrophotometry, 50-100um
  - *Planetary Tracking, 1 arcsec/sec*
  - *>75% of observing time for the General Scientific Community*
  - *2.5 yr Lifetime/5 yr Goal*
  - *Launch in Dec. 2001 (Delta 7920H)*
  - *Solar Orbit*
  - *$450 M Development Phase Cost Cap*
- **Cornerstone of NASA's Origins Program**



SIRTF System Architecture and Team Members



Defining Scientific Programs for SIRTF

- Protoplanetary and Planetary Debris Disks
- Brown Dwarfs and Super Planets
- Ultraluminous Galaxies and Active Galactic Nuclei
- The Early Universe

The SIRTF mission is driven only by the requirements of these programs, which are called out for SIRTF in the Bahcall Report

The resulting system will have very powerful capabilities in many other scientific areas, allowing SIRTF to be an ***observatory for the entire scientific community***

In addition, SIRTF will have great potential for the ***discovery*** *of new phenomena in the Universe, and the mission must exploit this potential*

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SIRTF Science Update

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Progress in each major science area highlights SIRTF's role:

- *2-MASS has discovered large numbers of Brown Dwarfs*
- *Keck imaging reinforces prevalence of Planetary Debris Disks*
- *Numerous Kuiper Belt Objects discovered outside Neptune's orbit*
- *Radial velocity detections show massive planets common around nearby stars*
- *ISO results show spectroscopic discrimination of starbursts and AGN achievable in infrared*
- *Hubble, Keck results show Universe full of galaxies at z>3*
- *DIRBE [COBE] detects submillimeter background resolvable by SIRTF*

SIRTF'S SCIENTIFIC PRIORITY HAS GROWN WITH TIME

JPL SIRTF Instrumentation Overview SIRTF

- **Infrared Array Camera, G.G.Fazio, SAO, PI.**

  Wide-field (5x5 arcmin) imaging. Simultaneous viewing at 3.6, 4.5, 5.8, 8um

  InSb and Si:As IBC arrays, 256x256 pixel format

- **Infrared Spectrograph, J.R.Houck, Cornell, PI.**

  R=600 echelle spectrographs, 10-20 and 20-40um

  R=50 long-slit spectrographs, 5-15um and 15-40um

  Imaging/Photometry, 15um

  Si:As and Si:Sb IBC arrays, 128x128 pixel format

- **Multi-band Imaging Photometer for SIRTF, G.Rieke, Arizona, PI.**

  Imaging and photometry: 24, 70, 160um; optimized for efficient large area surveys and superresolution; R~15 spectrophotometry, 50-100um

  Si:As IBC and Ge:Ga arrays, 128x128 and 32x32 format

  Stressed Ge:Ga array, 2x20 format

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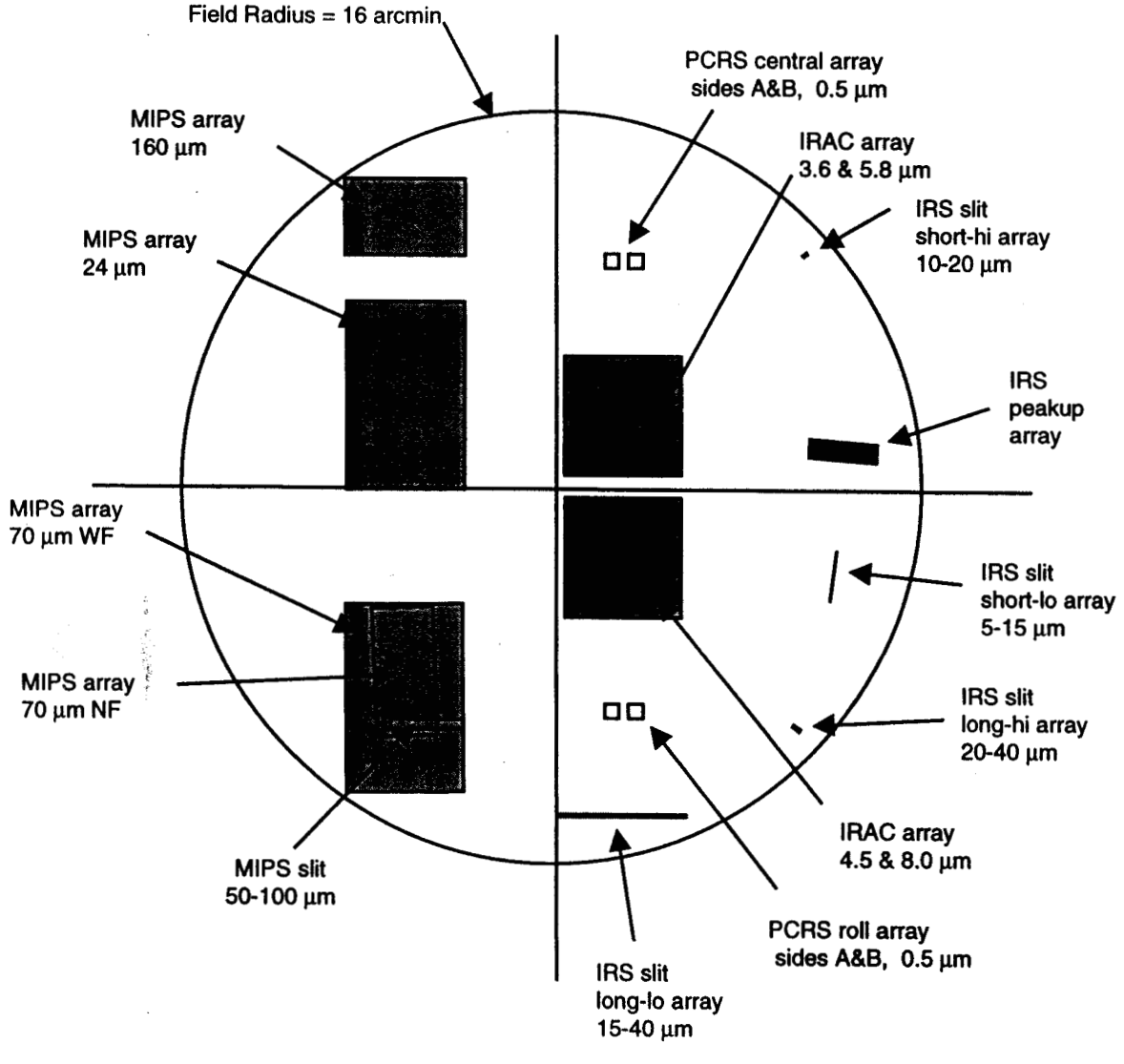
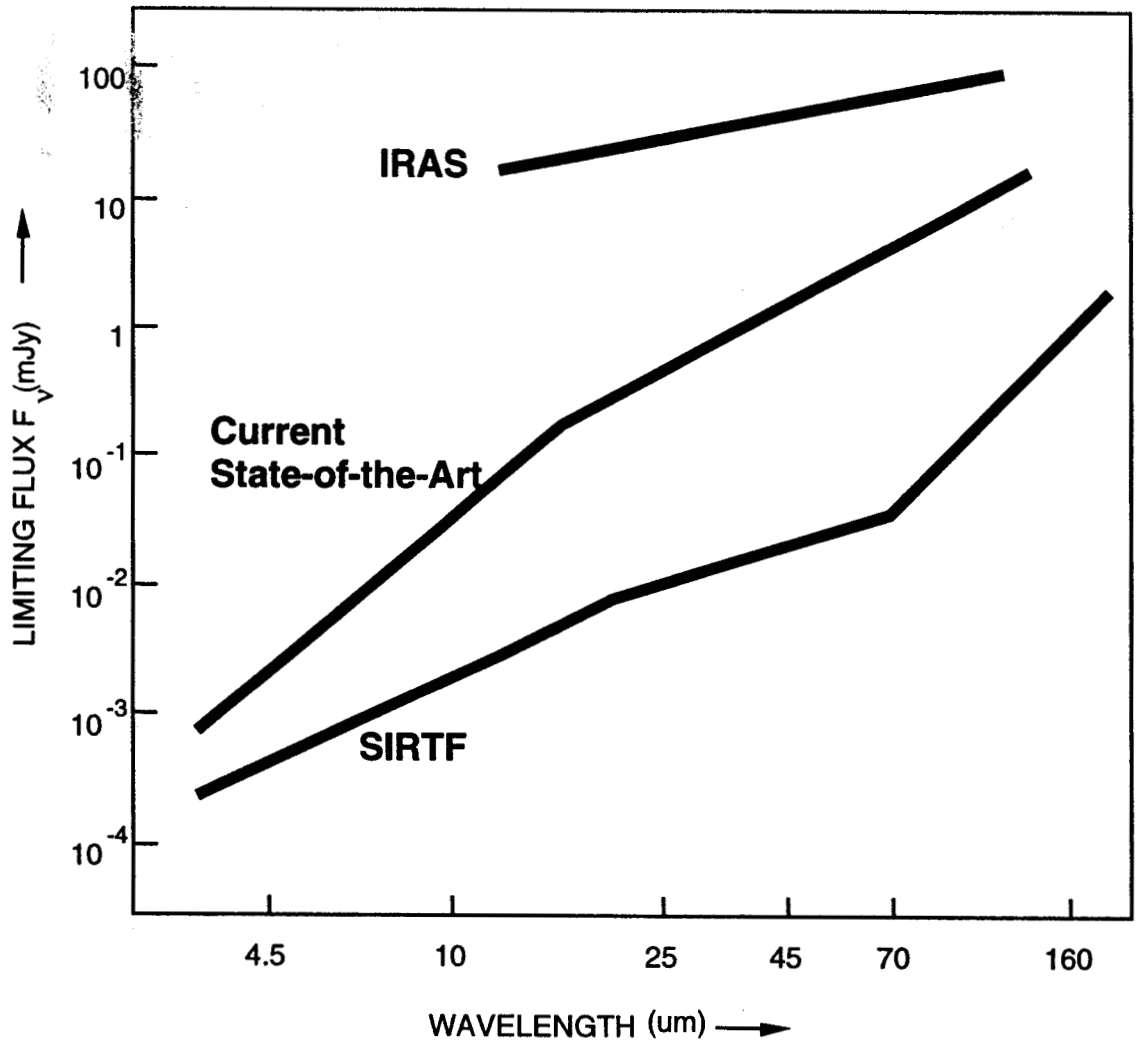
SIRTF Focal Plane Apertures

SIRTF



The Sensitivity of Infrared Telescopes



Simulated IRAC 3.5-8 μm View of the HDF

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Source Counts from IRAC Image

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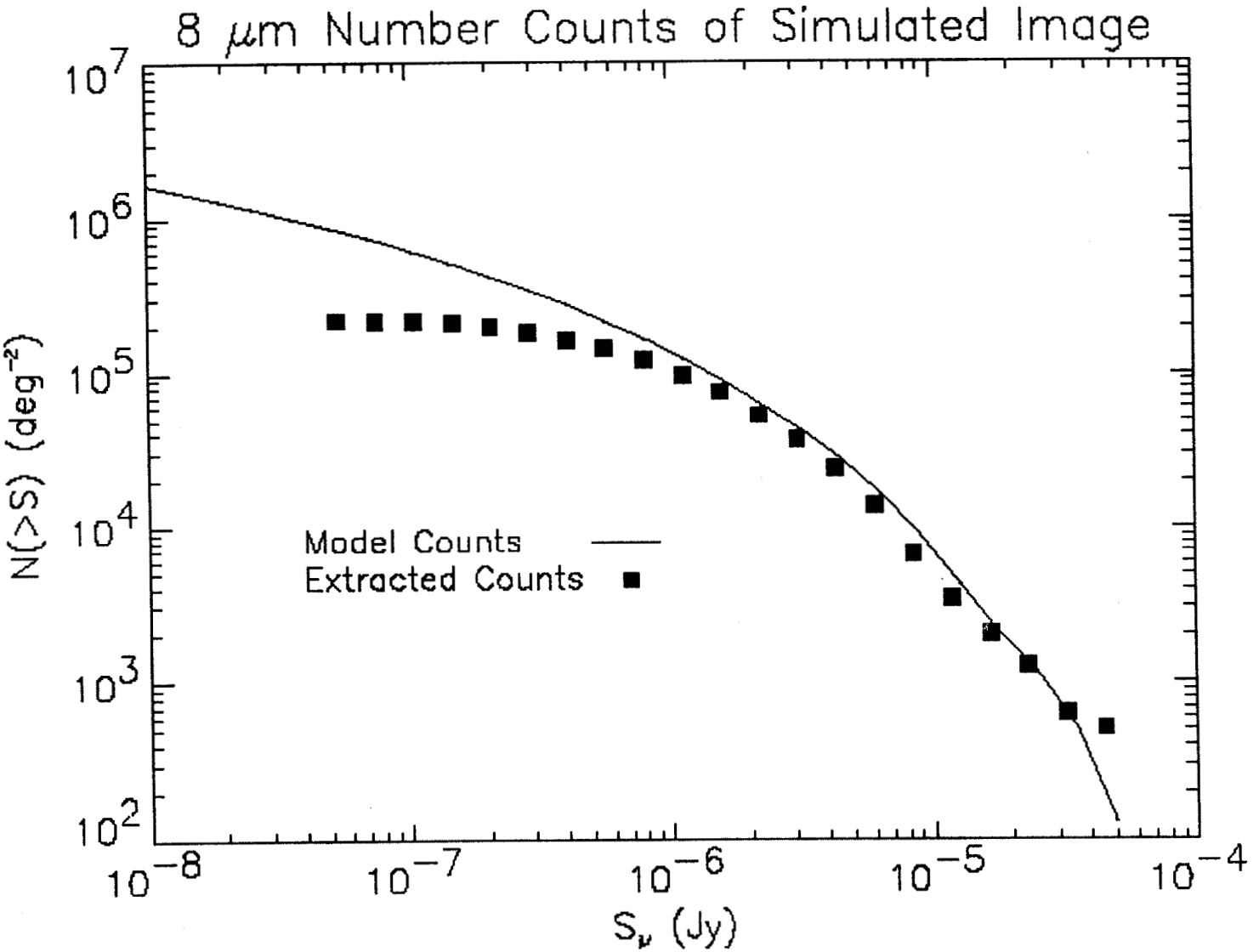
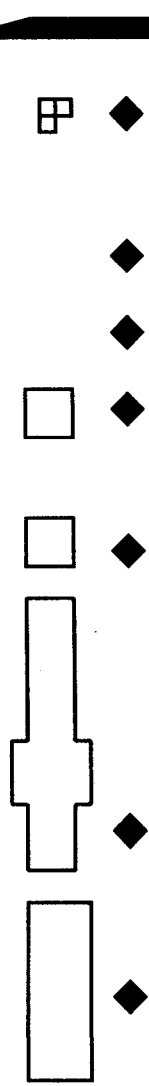


Coordination between GTO programs: The Groth Strip

JPL SIRTF



- Groth Strip is 28 overlapping WFPC-2 fields: 2800s @ V, 4400s @ I
- High ecliptic & galactic latitude, low IR cirrus: low SIRTF bkgd
- Oriented along ecliptic longitude line - SIRTF scan direction
- Ned Wright designated deep IRAC imaging of Groth Strip as 1st year GTO program, covering nine 5' x 5' fields at 4hr/position
- IRAC Deep Survey will cover 2 x 15 fields to same depth, extending strip 1.25 deg to NE. IRAC will cover 27 x 27' XMM field at ~500 sec/position
- MIPS Deep Survey will cover combined area
- UC DEEP/DEIMOS Keck project will obtain spectra for over 10,000 galaxies in this region

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Coordination between GTO programs: The Groth Strip

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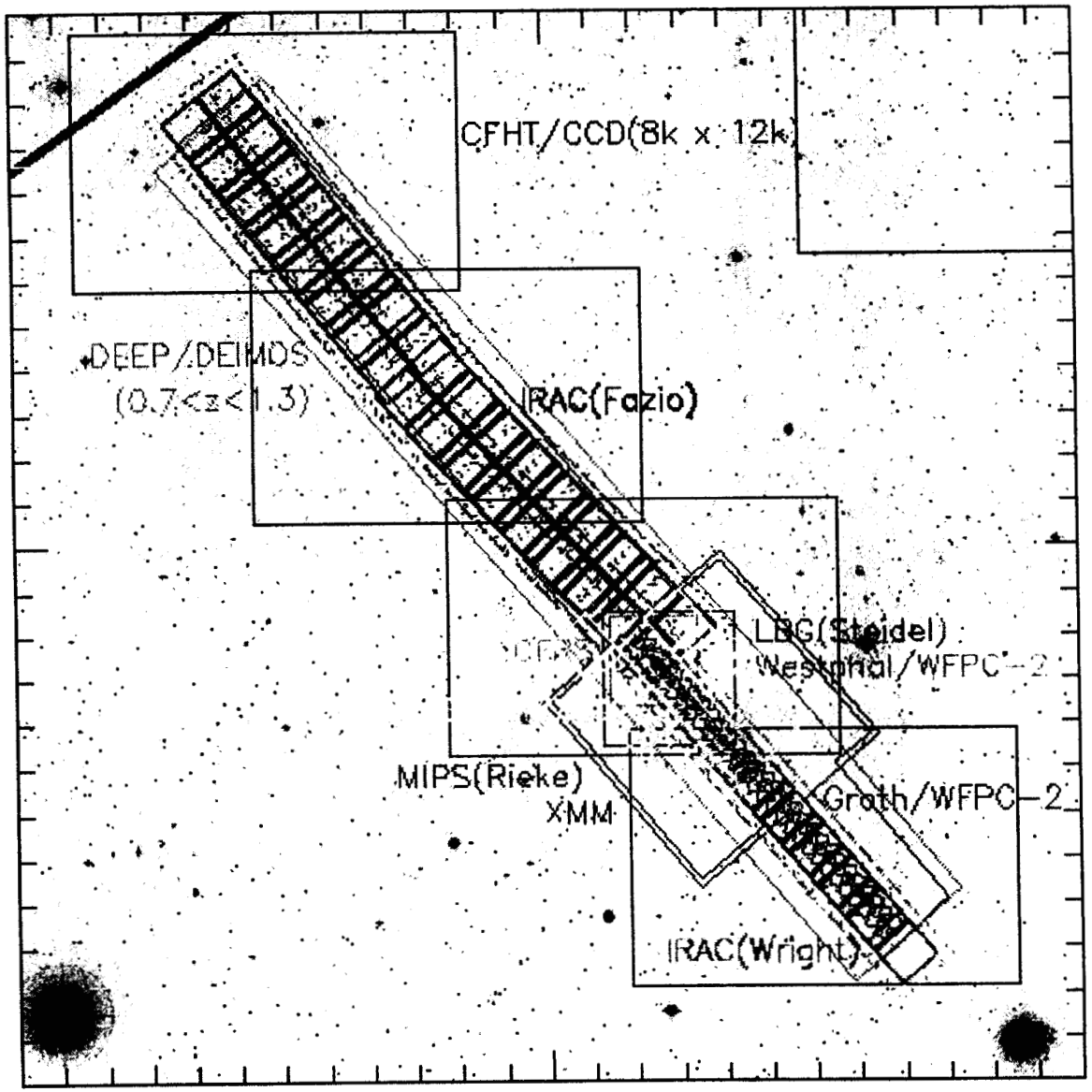

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IRS Wavelength Coverage

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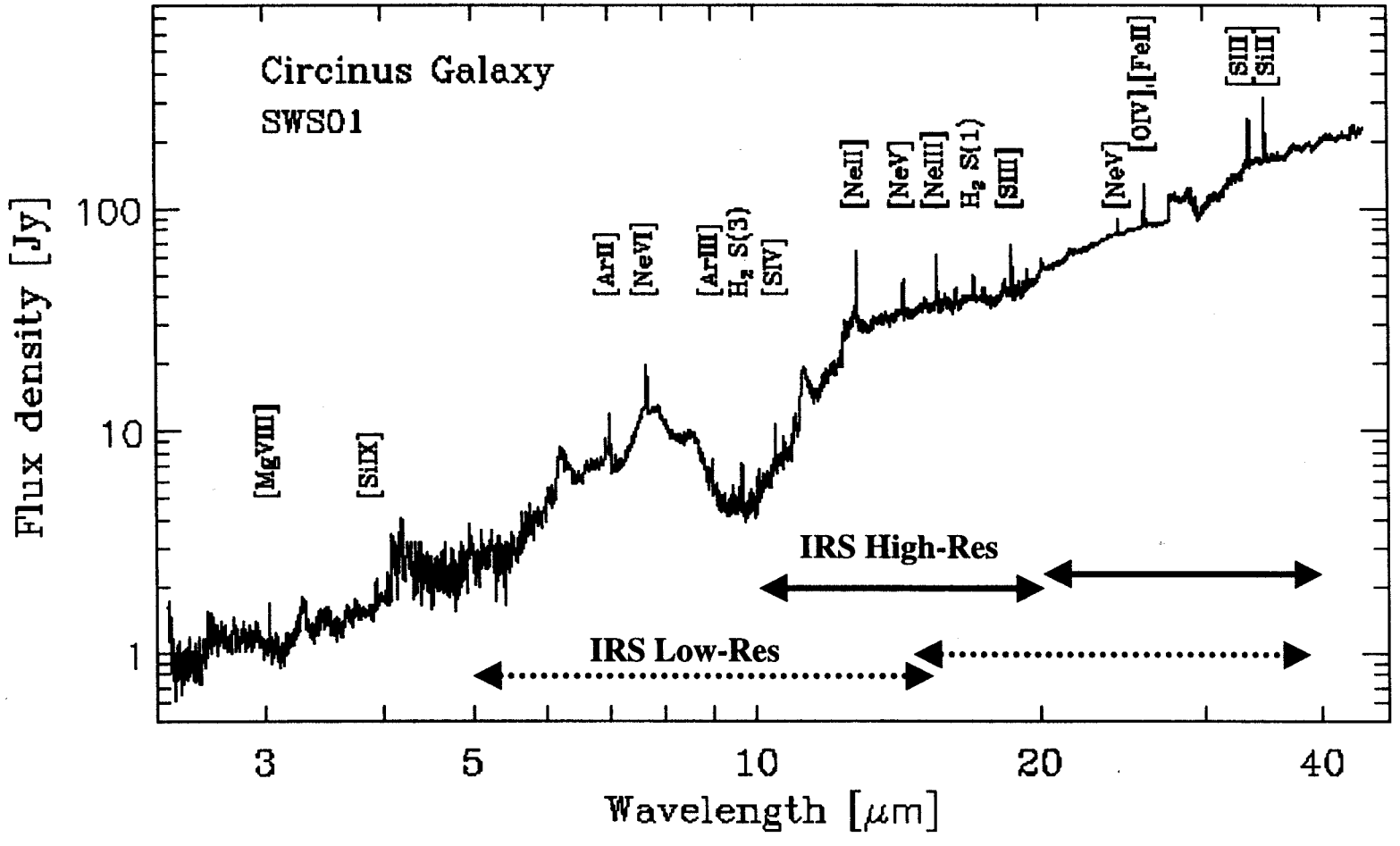

The 2.5 to 45 micron spectrum of the Circinus galaxy

This is the 2.5 to 45 micron spectrum of the Circinus galaxy obtained with the SWS instrument of ISO. This galaxy exhibits bright, narrow high-excitation emission lines typical of an AGN surrounded by an obscuring taurus.

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Simulated IRS Spectra of Distant Galaxies

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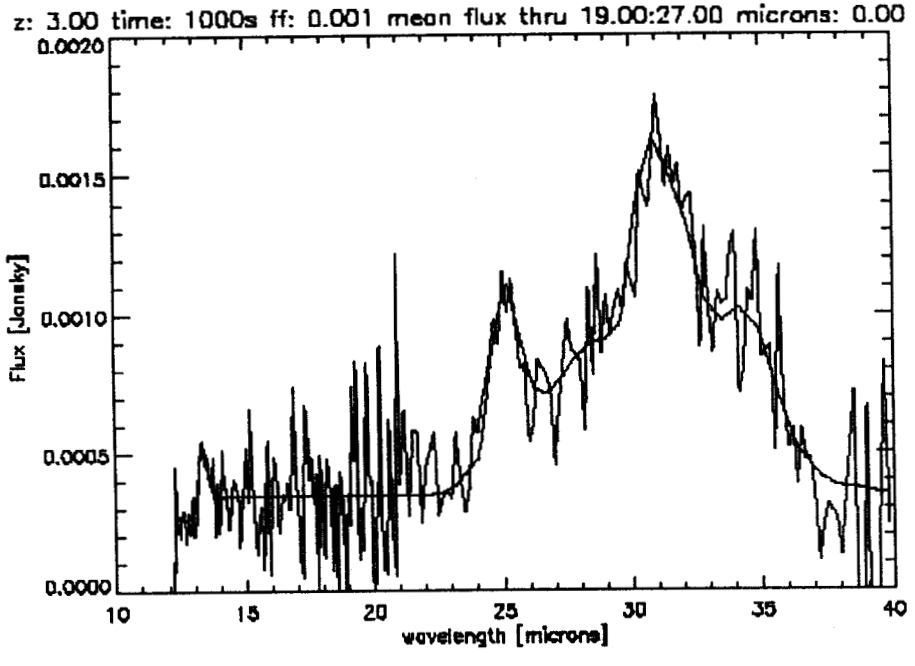
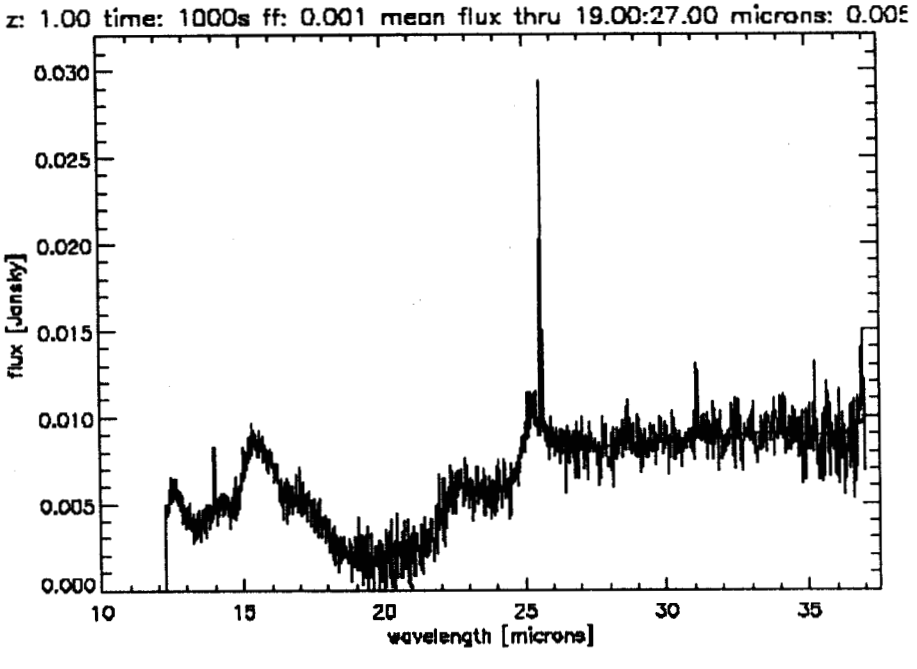


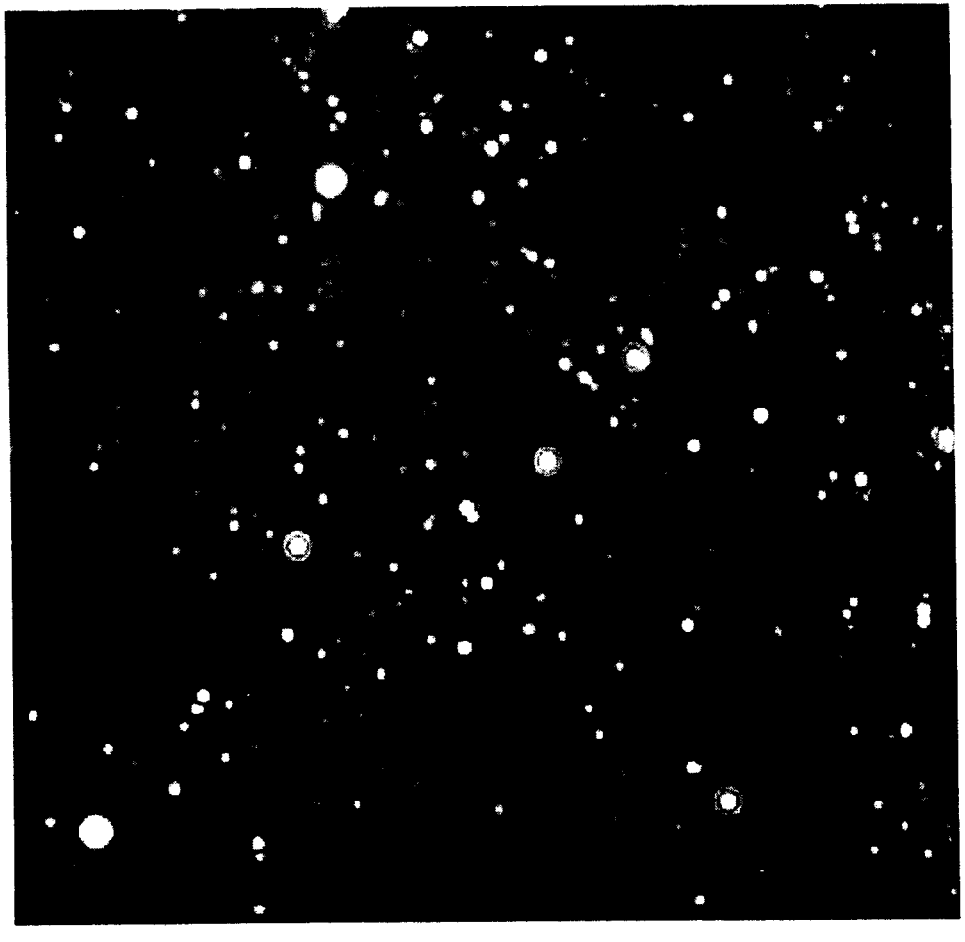
Low resolution spectrum of a faint galaxy at z=3. The redshift can be determined from the broad spectral features.



High resolution spectrum of a galaxy at z=1. Emission lines of neon in several ionization states are seen.

Simulated MIPS 70 micron Scan Map Data

The MIPS simulated sky is a 70 micron simulated scan map about 35 arcminutes square



Median Cirrus Flux	
24 μm	1.3×10^5 Jy/sr
70 μm	3.9×10^5 Jy/sr
160 μm	9.7×10^5 Jy/sr

Simulation by Chad Engelbracht (MIPS); go to http://mips.as.arizona.edu

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MIPS Observations may Resolve the Infrared Background at 160um

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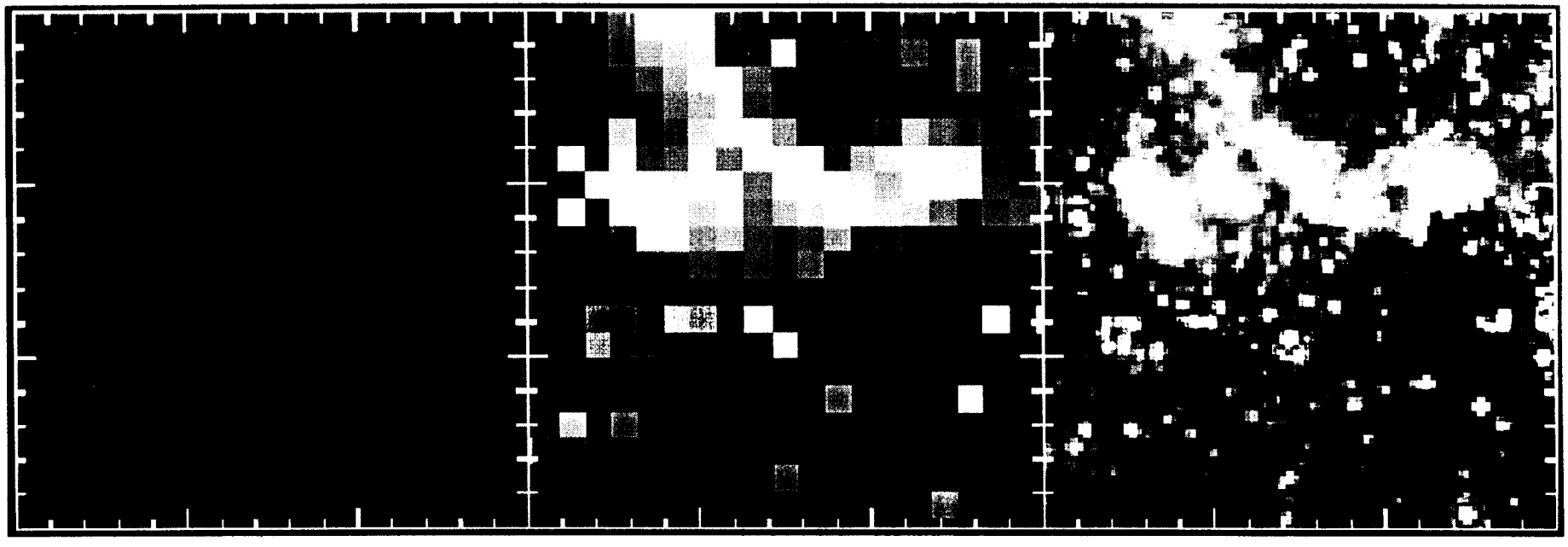
160 micron simulated sky, observed at different resolutions



DIRBE 45' **ISO 90"** **SIRTF 45"**

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Solar Orbit

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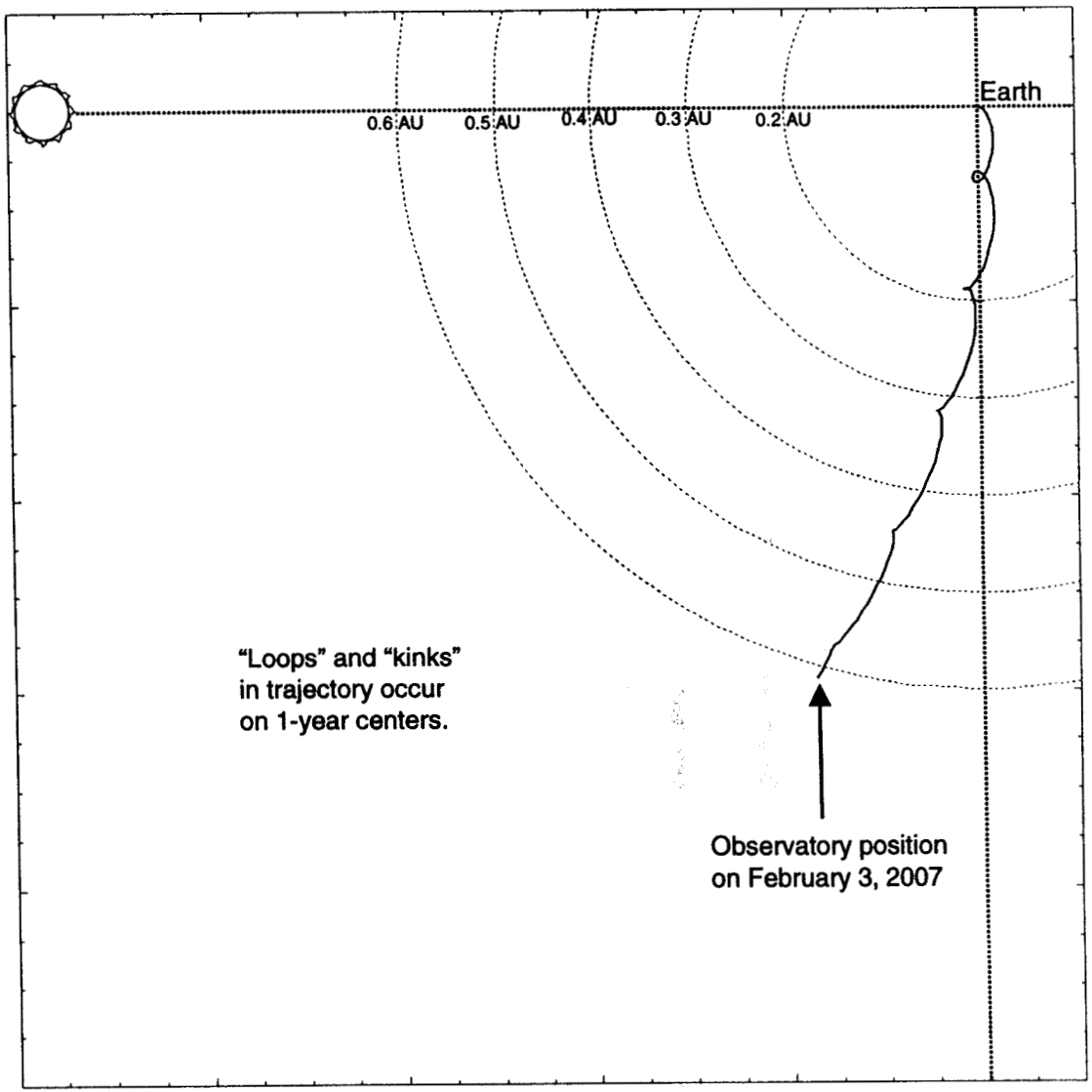
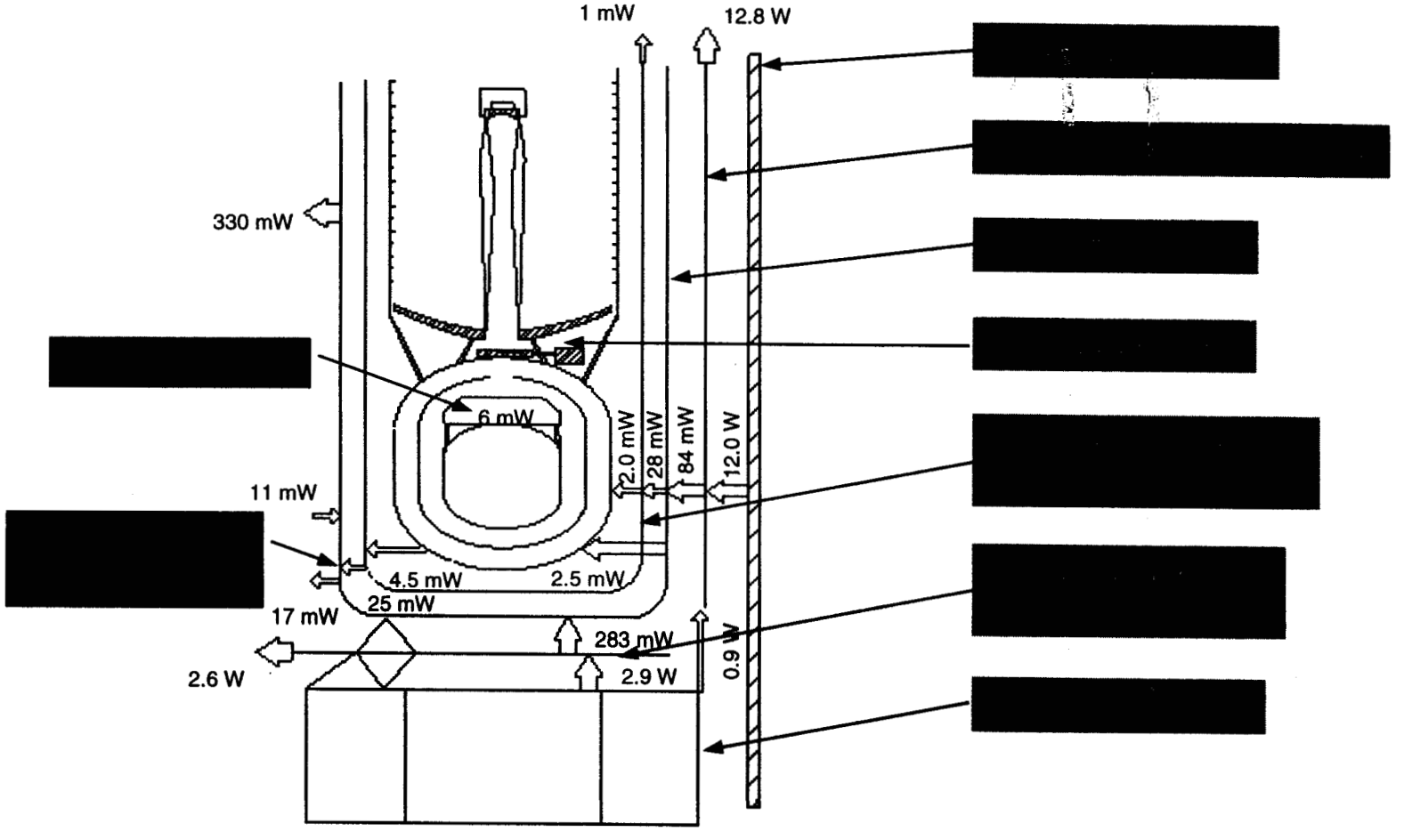
North Ecliptic Pole View in Rotating Frame

SIRTF's solar orbit projected onto the ecliptic plane and viewed from ecliptic North.

In the rotating frame, the Earth is at the origin and the Earth-Sun line is defined as the X-axis.



Heat Flow Map and Steady State Temps for Nominal Parameters



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SIRTF Science Utilization

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Observing Time on SIRTF will be Allocated in Three Categories:

- ***Community Time - >75%***
  - Open to entire Scientific Community and Peer reviewed. Includes:
    - *Legacy Science - Large, coherent investigations of lasting importance.*
      - Data placed in public archive immediately to promote follow-on with SIRTF. Emphasized early in mission.
    - *General Science - All other programs.*
- ***Guaranteed Time - SWG Members and Instrument Teams***
  - *20% of first 2.5 yrs of operations; 15% thereafter*
- ***Director's Discretionary Time - 5%***
- ***Archival Research will also be supported***
- ***SIRTF Science Center is User Interface to SIRTF***
  - *Tom Soifer is SSC Director; George Helou is Deputy*
  - *Visit the WEB SITE: http://sirtf.caltech.edu/*

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SIRTF Science Timeline

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- **Fall, 1999 to Launch -** *Learn more about SIRTF from AAS Workshops, Speakers' Bureau, Conference Talks, etc; Visit the Science Center Website* for information and to use time estimators for your scientific ideas*
- **April, 2000** - *Draft Release of Legacy Science Proposal Call*
- **April, 2000** - *Legacy Science Release of SPOT - SIRTF Planning and Observation Tool - available on Web*
- **May, 2000** - *SIRTF Science Conference - Galactic Astrophysics - in Grand Tetons*
- **June, 2000** - *Legacy Science Proposal Call*
- **September, 2000** - *Legacy Science Proposals due*
- **December, 2000** - *Legacy Science teams selected and funded*
- **October, 2001** - *Cycle 1 Call for General Observer Proposals*
- **December, 2001** - *Launch of SIRTF*
- **March, 2002**- *First Look Survey executed on orbit*
- **April, 2002** - *Cycle 1 General Observer Proposals due*
- **June, 2002** - *SIRTF Public Archive open*

**http://sirtf.caltech.edu/*

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SIRTF - A Summary

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- SIRTF is on target for December 2001 Launch
- Projected performance - optical, cryogenic, sensitivity - remains consistent with expectations as hardware comes together
- International participation in SIRTF is invited:
  - *Legacy Science Call is open as we speak*
  - *First General Observer opportunity in the Fall of 2001*
- SIRTF will be an extremely powerful tool for astrophysical exploration from the Solar System to the edge of the observable Universe